

AMENDMENTS TO THE CLAIMS

Claims 1-27. (Canceled)

28. (Currently Amended) The semiconductor substrate processing apparatus according to claim 27, 108, wherein said plated metal film forming unit, said bevel etching unit, and said annealing unit are interchangeable.

29. (Currently Amended) The semiconductor substrate processing apparatus according to claim 27, 108, comprising a film thickness measuring unit for measuring and/or detecting a film thickness of said film and/or a surface state of said film formed on said semiconductor substrate;

wherein said plated metal film forming unit, said bevel etching unit, said annealing unit, and said film thickness measuring unit are interchangeable.

30. (Original) The semiconductor substrate processing apparatus according to claim 29, wherein said film thickness measuring unit has an alignment function for said semiconductor substrate.

31. (Currently Amended) The semiconductor substrate processing apparatus according to claim 27, 108, wherein in said plated metal film forming unit, plating treatment and cleaning treatment are performed in such a state that said semiconductor substrate is held by a substrate holding portion.

32. (Currently Amended) The semiconductor substrate processing apparatus according to claim 27, 108, wherein said plated metal film forming unit comprises a substrate holding portion for holding said semiconductor substrate, an anode disposed above a surface, to be plated, of said substrate, a cathode electrode for passing an electric current in contact with said substrate, and a plating liquid impregnated material comprising a water retaining material, and is

operable to perform plating while said plating liquid impregnated material is placed in a space formed between said surface to be plated and said anode.

33. (Currently Amended) The semiconductor substrate processing apparatus according to claim 27, 108, wherein in said plated metal film forming unit, plating treatment, and cleaning and drying treatment are performed by raising and lowering said semiconductor substrate so as to correspond to respective operating positions, while said semiconductor substrate is held by a substrate holding portion.

34. (Currently Amended) The semiconductor substrate processing apparatus according to claim 27, 108, wherein said plated metal film forming unit holds said semiconductor substrate such that a surface, to be plated, of said semiconductor substrate faces upward, seals a peripheral edge portion of said surface, to be plated, of said semiconductor substrate with a seal in a watertight manner, has an anode disposed above said surface to be plated in proximity to said surface to be plated, has a cathode electrode for passing an electric current in contact with said semiconductor substrate, and performs plating while a plating liquid is held in a space formed by said surface, to be plated, of said semiconductor substrate and said seal.

35. (Currently Amended) The semiconductor substrate processing apparatus according to claim 27, 108, wherein said plated metal film forming unit comprises a substrate holding portion for holding said semiconductor substrate such that a surface, to be plated, of said semiconductor substrate faces upward, an anode disposed above said surface, to be plated, of said semiconductor substrate, a cathode electrode for passing an electric current in contact with said semiconductor substrate, and a pure water supply nozzle, and simultaneously cleans said semiconductor substrate and said cathode by supplying pure water from said nozzle after completion of plating treatment.

Claims 36-107. (Canceled)

108. (New) A semiconductor substrate processing apparatus, comprising:
a carry-in and carry-out section for carrying in and carrying out a semiconductor substrate having a surface on which a circuit is formed, in a dry state;
a plated metal film forming unit for forming a plated metal film on said semiconductor substrate which has been carried in;
a bevel etching unit including
(i) a central fluid discharge member and a source of acid solution in fluid communication with said central fluid discharge member, and
(ii) a peripheral fluid discharge member and a source of oxidizing agent solution in fluid communication with said peripheral fluid discharge member,
wherein said central fluid discharge member and said peripheral fluid discharge member are constructed and arranged to, during rotation of said semiconductor substrate, supply the acid solution from said source of acid solution to a central portion of said semiconductor substrate and supply the oxidizing agent solution from said source of oxidizing agent solution to a peripheral edge portion of said semiconductor substrate, respectively, for thereby etching and removing at least one of said plated metal film, a seed layer and a barrier layer formed at the peripheral edge portion of said semiconductor substrate, and said bevel etching unit is also operable to rotate said semiconductor substrate so as to spin-dry said semiconductor substrate after having been etched;
an annealing unit for annealing said semiconductor substrate; and
a transport mechanism for transporting said semiconductor substrate between said units, said transport mechanism having a dry hand for handling said semiconductor substrate in a dry state and a wet hand for handling said semiconductor substrate in a wet state.

109. (New) A bevel etching unit for etching a semiconductor substrate, comprising:
a central fluid discharge member and a source of acid solution in fluid communication with said central fluid discharge member; and
a peripheral fluid discharge member and a source of oxidizing agent solution in fluid communication with said peripheral fluid discharge member,

wherein said central fluid discharge member and said peripheral fluid discharge member are constructed and arranged to, during rotation of a semiconductor substrate, supply the acid solution from said source of acid solution to a central portion of the semiconductor substrate and supply the oxidizing agent solution from said source of oxidizing agent solution to a peripheral edge portion of the semiconductor substrate, respectively, for thereby etching and removing at least one of a plated metal film, a seed layer and a barrier layer formed at the peripheral edge portion of the semiconductor substrate.

110. (New) A semiconductor substrate processing apparatus, comprising:
a carry-in and carry-out section for carrying in and carrying out a semiconductor substrate having a surface on which a circuit is formed, in a dry state;
a plated metal film forming unit for forming a plated metal film on said semiconductor substrate which has been carried in, said plated film forming unit including
(i) a substrate holding portion for holding said semiconductor substrate,
(ii) an anode disposed above a surface, to be plated, of said substrate when said substrate is held by said substrate holding portion,
(iii) a cathode electrode in contact with said substrate when said substrate is held by said substrate holding portion,
(iv) a member to be impregnated with plating liquid, said member comprising a water retaining material and being positioned between said anode and said surface to be plated when said substrate is held by said substrate holding portion, and
(v) a peripheral seal member in contact with said substrate and surrounding a part of said member to be impregnated with plating liquid when said substrate is held by said substrate holding portion,

wherein said substrate holding portion, said anode, said cathode electrode, said member to be impregnated with plating liquid, and said peripheral seal member are constructed and arranged to form a plated film on said surface, to be plated, of said semiconductor substrate when held by said substrate holding portion, by impregnating said member with said plating liquid, and retaining said plating liquid on said substrate by virtue of said seal member, while

passing an electrical current through said cathode electrode;

a bevel etching unit operable to supply an acid solution to a center portion of said semiconductor substrate being rotated and to supply an oxidizing agent solution to a peripheral edge portion of said semiconductor substrate for etching and removing at least one of said plated metal film, a seed layer and a barrier layer formed at the peripheral edge portion of said semiconductor substrate, and operable to rotate said semiconductor substrate so as to spin-dry said semiconductor substrate which has been etched;

an annealing unit for annealing said semiconductor substrate; and

a transport mechanism for transporting said semiconductor substrate between said units, said transport mechanism having a dry hand for handling said semiconductor substrate in a dry state and a wet hand for handling said semiconductor substrate in a wet state.

111. (New) A plated metal film forming unit for forming a plated metal film on a semiconductor substrate, comprising:

a substrate holding portion for holding the semiconductor substrate;

an anode disposed above a surface, to be plated, of the substrate when the substrate is held by said substrate holding portion;

a cathode electrode in contact with the substrate when the substrate is held by said substrate holding portion;

a member to be impregnated with plating liquid, said member comprising a water retaining material and being positioned between said anode and the surface to be plated when the substrate is held by said substrate holding portion; and

a peripheral seal member in contact with the substrate and surrounding a part of said member to be impregnated with plating liquid when the substrate is held by said substrate holding portion,

wherein said substrate holding portion, said anode, said cathode electrode, said member to be impregnated with plating liquid, and said peripheral seal member are constructed and arranged to form a plated film on the surface of the semiconductor substrate, when held by said substrate holding portion, by impregnating said member with the plating liquid, and retaining the

plating liquid on the surface of the substrate by virtue of said seal member, while passing an electrical current through said cathode electrode.

112. (New) A semiconductor substrate processing apparatus, comprising:
a carry-in and carry-out section for carrying in and carrying out a semiconductor substrate having a surface on which a circuit is formed, in a dry state;

a plated metal film forming unit for forming a plated metal film on said semiconductor substrate which has been carried in, said plated film forming unit including

- (i) a substrate holding portion for holding said semiconductor substrate,
- (ii) an anode disposed above a surface, to be plated, of said substrate when said substrate is held by said substrate holding portion,
- (iii) a cathode electrode for passing an electric current in contact with said substrate when said substrate is held by said substrate holding portion,
- (iv) a seal member positioned inwardly of said cathode electrode and in contact with said substrate when said substrate is held by said substrate holding portion,
- (v) a plating liquid supply member for supplying plating liquid onto said semiconductor substrate when held by said substrate holding portion, and
- (vi) a pure water supply member for supplying pure water after formation of the plated film,

wherein said substrate holding portion is movable, from a first position to a second position, away from said seal member and said cathode electrode such that pure water supplied when said substrate holding portion is in the first position is retained on said semiconductor substrate by said seal member, and pure water supplied when said substrate holding portion is in the second position underflows said seal member and contacts said cathode electrode for cleaning said cathode electrode;

a bevel etching unit operable to supply an acid solution to a center portion of said semiconductor substrate being rotated and to supply an oxidizing agent solution to a peripheral edge portion of said semiconductor substrate for etching and removing at least one of said plated metal film, a seed layer and a barrier layer formed at the peripheral edge portion of said

semiconductor substrate, and operable to rotate said semiconductor substrate so as to spin-dry said semiconductor substrate which has been etched;

an annealing unit for annealing said semiconductor substrate; and

a transport mechanism for transporting said semiconductor substrate between said units, said transport mechanism having a dry hand for handling said semiconductor substrate in a dry state and a wet hand for handling said semiconductor substrate in a wet state.

113. (New) A plated metal film forming unit for forming a plated metal film on a semiconductor substrate, comprising:

a substrate holding portion for holding the semiconductor substrate;

an anode disposed above a surface, to be plated, of the substrate when the substrate is held by said substrate holding portion;

a cathode electrode for passing an electric current in contact with the substrate when the substrate is held by said substrate holding portion;

a seal member positioned inwardly of said cathode electrode and in contact with the substrate when the substrate is held by said substrate holding portion;

a plating liquid supply member for supplying plating liquid onto the substrate when held by said substrate holding portion; and

a pure water supply member for supplying pure water after formation of the plated film, wherein said substrate holding portion is movable, from a first position to a second position, away from said seal member and said cathode electrode such that pure water supplied when said substrate holding portion is in the first position is retained on the substrate by said seal member, and pure water supplied when said substrate holding portion is in the second position underflows said seal member and contacts said cathode electrode for cleaning said cathode electrode.

114. (New) A semiconductor substrate processing apparatus, comprising:

a carry-in and carry-out section for carrying in and carrying out a semiconductor substrate having a surface on which a circuit is formed;

a plated metal film forming unit for forming a plated metal film on said semiconductor substrate which has been carried in;

a bevel etching unit including

(i) a central fluid discharge member and a source of acid solution in fluid communication with said central fluid discharge member, and

(ii) a peripheral fluid discharge member and a source of oxidizing agent solution in fluid communication with said peripheral fluid discharge member,

wherein said central fluid discharge member and said peripheral fluid discharge member are constructed and arranged to, during rotation of said semiconductor substrate, supply the acid solution from said source of acid solution to a central portion of said semiconductor substrate and supply the oxidizing agent solution from said source of oxidizing agent solution to a peripheral edge portion of said semiconductor substrate, respectively, for thereby etching and removing at least one of said plated metal film, a seed layer and a barrier layer formed at the peripheral edge portion of said semiconductor substrate, and said bevel etching unit is operable to rotate said semiconductor substrate so as to spin-dry said semiconductor substrate which has been etched, and operable to change a bevel etching time based on a thickness of said plated metal film;

an annealing unit for annealing said semiconductor substrate;

a film thickness measuring unit for measuring and/or detecting a film thickness of said film and/or a surface state of said film formed on said semiconductor substrate; and

a transport mechanism for transporting said semiconductor substrate between said units.

115. (New) A semiconductor substrate processing apparatus, comprising:

a carry-in section for carrying in a semiconductor substrate having a surface on which a circuit is formed;

a plated metal film forming unit for forming a plated metal film on said semiconductor substrate which has been carried in;

an annealing unit for annealing said semiconductor substrate;

a cleaning unit for cleaning said semiconductor substrate; and

a transport mechanism for transporting said semiconductor substrate between said units;
wherein said plated metal film forming unit includes

(i) a seal member,

(ii) a substrate holding portion adapted to be raised and lowered between a lower position, an upper position, and a middle position,

(iii) a plating liquid supply member, and

(iv) a water supply member,

such that said semiconductor substrate is placed onto said substrate holding portion at the lower position, said seal member is pressed against a peripheral edge portion of said semiconductor substrate at the upper position to allow a plating liquid supplied from said plating liquid supply member to be retained on an upper surface of said semiconductor substrate, and cleaning water is supplied from said water supply member to said semiconductor substrate at the middle position.

116. (New) A semiconductor substrate processing apparatus, comprising:
a carry-in and carry-out section for carrying in and carrying out a semiconductor substrate having a surface on which a circuit is formed, in a dry state;

an electroless plating apparatus for performing electroless plating process on said semiconductor substrate;

an electroplating apparatus for performing electroplating process on said semiconductor substrate;

a bevel etching unit for etching a peripheral edge portion of said semiconductor substrate;
and

a cleaning and drying unit for cleaning and drying the semiconductor substrate to which plating has been applied;

wherein said electroplating apparatus includes

(i) a seal member,

(ii) a substrate holding portion adapted to be raised and lowered between a lower position, an upper position, and a middle position,

(iii) a plating liquid supply member, and

(iv) a water supply member,

such that said semiconductor substrate is placed onto said substrate holding portion at the lower position, said seal member is pressed against an peripheral edge portion of said semiconductor substrate at the upper position to allow a plating liquid supplied from said plating liquid supply member to be retained on an upper surface of said semiconductor substrate, and cleaning water is supplied from said water supply member to said semiconductor substrate at the middle position.

117. (New) A semiconductor substrate processing apparatus, comprising:
a carry-in section for carrying in a semiconductor substrate having a surface on which a circuit is formed;
a liquid supply equipment having a plating liquid tank;
a plating module for performing plating process on a semiconductor substrate;
an annealing unit for annealing said semiconductor substrate;
a bevel etching unit for etching a peripheral edge portion of said semiconductor substrate; and
a transport mechanism for transporting said semiconductor substrate.
wherein said plating module includes

(i) a seal member,

(ii) a substrate holding portion adapted to be raised and lowered between a lower position, an upper position, and a middle position,

(iii) a plating liquid supply member, and

(iv) a water supply member,

such that said semiconductor substrate is placed onto said substrate holding portion at the lower position, said seal member is pressed against an peripheral edge portion of said semiconductor substrate at the upper position to allow a plating liquid supplied from said plating liquid supply member to be retained on an upper surface of said semiconductor substrate, and cleaning water is supplied from said water supply member to said semiconductor substrate at the middle position.